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Price Setting Behaviour in Economic Community of West African States: Some Stylized Facts

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Abstract

This study analysed the stylized facts that characterised price-setting behaviour in the Economic Community of West African States (ECOWAS). The price database consisted of unique highly disaggregated micro-level retail level price data underlying the computation of the National Consumer Price Index (CPI) in Nigeria, Benin and Togo and was collected monthly for five years from January 2011 to December 2015. Descriptive statistics were used to align theories of price rigidities with the price dataset. Findings from this study showed that price-setting behaviour differs across the three countries. Specifically, the frequency of price changes is not the same across the three countries with high price volatility in Nigeria as Togo and Benin probably due to their different monetary regimes. There are more price increases than price decreases across the three countries signifying price rigidity downward. Also, the average price spell varies across the three countries with Nigeria having a shorter spell than Togo and Benin. The frequency of price changes also showed a seasonal pattern across the three countries but at different times of the year. Inflation also co-varies with the size of price changes for the three countries indicating that the state-dependent pricing model fits the data for the region than the time-dependent pricing model. These results have two policy implications. The need for a stable macroeconomic environment in the region and reduction in price volatility in Nigeria relative to Togo and Benin.

Keywords: price setting, price rigidities, macroeconomic shocks

JEL Classifications: E39: L16

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1. Introduction

Price setting behaviour impacts the economy from both microeconomic and macroeconomic perceptive. The former reflects the competitive behaviour at the sectoral level and how firms react to their economic environment and its impact on their competitiveness and profitability (Marahay, 2012). The latter deals with its implications on welfare consequences of business cycles and behaviour of real exchange rates (Parker, 2014: Nakamura and Steinsson, 2008). Nominal rigidities are constraints describing situations where the price of a product does not change immediately to new market clearing price despite changes in the broad economy. Price stickiness in one sector can lead to price stickiness in another sector and therefore make the aggregate price level to be sluggish and less responsive to changes in macro-economic shocks (Dixon & Hansen, 1999). The presence of price stickiness therefore explains why markets do not reach equilibrium. It is regarded as a starting point in modern micro-founded macro models because it is viewed as a principal determinant of the response to nominal shocks that strike an economy (Nchake, 2013; Dias, Marques & Santos-Silva, 2007). Also, how price adjustment varies with inflation is another very important issue in the literature as it determines inflationary dynamics. Price stickiness is, therefore, an important feature in the transmission mechanism of monetary policy which can facilitate integration across the market or within the market. It is also an important determinant of product market integration as it expresses the firm's ability to exploit price differences across the market and thereby

Despite the importance of the price-setting behaviour of firms, there are very limited studies on price-setting behaviour in ECOWAS as research in this field lack evidence on West Africa. This is largely because the requisite disaggregated data are unavailable for developing countries where economic shocks are frequent and inflation rates are often high and variable. Also, the existence of weak infrastructure, poor distribution network and inefficient markets create friction in a price adjustment. This structural weakness in the market conditions of developing countries requires a new body of empirical literature that will show how these conditions fit into theoretical models of price-setting behaviour. However, little is known about the price-setting behaviour in the ECOWAS. It is important, therefore, to obtain direct and independent evidence on the price rigidities in ECOWAS to find out which price-setting rule can best explain actual price-setting behaviour.

Investigating price-setting behaviour gives an understanding of the nominal rigidities and their causes, how firms adjust prices in the marketplace, the extent of price responsiveness to changes in economic conditions and the extent to which price reacts asymmetrically to demand or supply shocks. This study documents and contrasts the empirical characteristics observable in the ECOWAS data and thereby gains insight into the typical pattern of price change at the

microeconomic level by addressing two basic questions. First, what characterizes the price-setting behaviour in ECOWAS? Second, which of the pricing rules fit the price dataset from the region? Specific answers to these questions will help policymakers as they consider the impact of monetary policy and inflationary dynamics on the welfare of the people of the region.

While studies on price-setting behaviour for West Africa are scarce, there have been studies for Southern Africa (Nchake, 2015: Balchin, 2013). These two studies do provide evidence that is not consistent with similar studies from developed economies raising the suspicion that price datasets from Africa may not fit differently to theories of price setting. We attempt to test whether this hypothesis holds from West Africa, using three countries of Nigeria, Benin and Togo, which account for 76 per cent of the sub-region GDP. Our findings show that price-setting behaviour differs across the three countries used as a sample for the sub-region. Specifically, the frequency of price changes is not the same across the three countries and there are more price increases than price decreases suggesting that prices are rigid downward and the average price spell varies across the three countries differs. Also, the frequency of price changes exhibits a seasonal pattern across the three countries but at different times of the year. Finally, inflation co-varies with the size of price changes and this means that state-dependent pricing model fits the data for the sub-region than time-dependent pricing model.

Our study contributes to the emerging literature on price-setting behaviour in Africa in four distinct ways. Firstly, we use a wide range of products than previous studies for West Africa and through this has been able to provide a more robust result. Secondly, we have been able to construct an appropriate dataset from retail prices for the three countries in the region. We consider this a unique contribution in a region where data of this nature is difficult to collect and therefore, scarce. Thirdly, our results have shown that the retail dataset for West Africa does fit into the same theoretical model as that of developed economies. This is consistent with results from other developing economies, indicating that the region also faces the same challenges as other developing countries. Fourthly, our results also show that the different monetary regimes in the region have implications for price volatility among member countries of ECOWAS.

This paper is organised as follows: Section 2 reviews relevant literature. Section 3 describes the methodology, which consists of data source and study area, model specification and theoretical framework. Section 4 presents the results, while section 5 concludes with policy implications.

2. Literature Review

2.1 Theoretical Literature

The literature on the role of price setting in economics has evolved starting with variants of rational expectations and real business cycle models in the 1980s and 1990s. These variants did not acknowledge the role of price rigidity in stimulating economic growth during periods of slack in demand. Recent literature, however, reveals the general acceptance of the role of price setting in stimulating growth and acknowledges that price-setting behaviour has outstanding consequences on business cycles, the behaviour of real exchange rates, the speed with which the monetary authorities attempt to bring inflation back to target after disturbance, the type of response to excess demand or supply and the process by which changes in monetary policy are transformed to real activity and inflation (Amirault, Kwan and Wilkin, 2005).

Broadly speaking, the literature suggests two types of theoretical models of price-setting behaviour, namely, the time-dependent model and the state-dependent model. While both models imply the presence of a certain degree of stickiness their aggregate implications, positive and negative, can differ as they predict strikingly different macroeconomics implications (Nakamara & Steinsson, 2008: Caplin & Spulber 1987: Wolman, 1991)

In specific terms, the time-dependent pricing model describes price change that is determined by the passage of calendar time as a result of the outcome of the optimization process by the firm (Small&Yates, 1999). There is thus an exogenous staggering of price changes across firms in the economy in which a fixed fraction of the number of firms alter their prices in each period (Nchake, 2013: Klenow & Kryvtsov, 2008). Overall, time-dependent models have little scope for generating bunching found in price changes, cannot generally match many patterns uncovered in new micro data sets, and imply that firms are not allowed to respond even to extreme changes of circumstances between (exogenously specified) price adjustments (Neiman, 2009: Caplin & Leahy, 1991).

The state-dependent model assumes that firm adjusts their prices as a result of the outcome of an optimization problem with the timing of price change being when the result of the cost-benefit analysis indicates that the benefits outweigh the fixed costs of adjustment. The optimal pricing policy is to keep prices within the two real price bounds, S and s. Inflation erodes the real price upper bound S until it reaches the lower threshold s at which point the firm increases the price to the upper bound (Sheshinski & Weiss, 1977).

The assumption of endogenous timing of price changes in which the frequency of price change is dependent on macroeconomic conditions is more realistic although more difficult to incorporate

into macroeconomic models. In comparison to time-dependent pricing models, the real effects of monetary shocks are less persistent for a comparable economic setup, the impulse response is more transient than a standard time-dependent pricing model, the frequency of price change is relatively not affected, and the intensive margin is relatively more important than extensive margin.

2.2 Empirical Review

An evaluation of empirical studies on price-setting behaviour shows two basic shortcomings. Firstly, studies conducted in developed economies dominated the literature and these include United Kingdom (Parker and Greenslade, 2001), Portugal (Martin, 2005), Euro area (Fabiani, Galtulli, Saabbabini and Verosene, 2006) and Canada (De-Munik and Xu, 2007). Secondly, these studies were driven by single firms or single markets, (Kashyap, 1995), single products or relatively narrow sets of products (Cecchetti, 1986) and this affect their abilities to provide convincing evidence for price stickiness for the broad economy. In an attempt to sidestep this major flaw a group of empirical studies has used microdata at the retail price level which is considered capable of providing better insight into the characteristics of price-setting behaviour. Some of the studies in this category include Bils and Klenow, (2004) and Nakamura and Steinson, (2008) for United States, Parker, (2004) for New Zealand, Gouvea (2007) for Brazil, Balchin, (2015) for SADC and Nchake, (2013) for Lesotho.

These studies have come to provide broad empirical microeconomic evidence on price-setting behaviour across different regions using microdata. However, empirical evidence on price setting has shown that price-setting strategies are sensitive to different industries and countries. For instance, Martin (2005) finds that the degree of nominal rigidity is higher in the service sector than goods sector. Almirault *et al* (2005) find that Canadian firms have an asymmetrical response of price change in economic conditions, while Small and Yates, (1999) find that market structure affects nominal rigidity. In the same vein, hazard rates have been found to differ across countries and industries (Nchake, 2013: Klenow and Krystov, 2008: Creamer, Tarrelli and Rankin, 2012, Nakamura and Steinson, 2008 and Auccramanne and Dhyne, 2008), while Kovac, (2006) and Auccramanne and Dhyne, (2008) discover a greater variability in the degree of synchronization across product categories.

Also, empirical evidence has shown that price changes in developing countries do not generally display considerable stickiness like developed countries due primarily to the structure of these poor economies which is rather basic (Kovanem, 2006). In the same vein, the literature indicates that the time-dependent pricing model fits microdata from developed economies, while state-dependent matches data from developing economies.

Overall, these studies reveal two basic regularities. One, the degree of price rigidity in terms of frequency, duration and size varies across industries and countries and across time even in the same country. Two, no theoretical pricing model exactly matches the empirical features found in the data and while certain industries would employ a time-dependent pricing rule in one country, the same industries can employ a state-dependent pricing rule in another country. Thus, it is concluded that there is no particular pattern of price-setting behaviour for a particular group of countries or industries or products. This, therefore, makes it important that studies should be done with specific data for areas not yet captured in the literature.

3. Methodology

3.1 Study Area

This study focuses on the Republic of Benin, Nigeria and Togo out of the fifteen countries in ECOWAS. These three countries present unique cases because they have been members of ECOWAS since it was founded in 1975. The three countries represent 76 per cent of the economy of the sub-region and belong to two different monetary unions. Benin and Togo belong to the West African Economic and Monetary Union (WAEMU) with a common monetary policy and pegged their currencies to the French Franc, while Nigeria belongs to West African Monetary Zone (WAMZ) and has an independent monetary framework. Also, the geographical location is such that Benin is in-between Nigeria and Togo.

3.2 Data

The price concept used for all producers corresponds to the price per unit. Thus, if an unchanged price report corresponds to a changed quantity (either increase or decrease in quantity), the price per unit changes and hence a price change is observed. A sequential procedure was used to monitor individual products overtime within a product category, the individual product is observed in *t, t-1, t+1* if it fulfils the following conditions:

$$Location_t = Location_{t-1} = Location_{t+1}$$

$$Store_t = Store_{t-1} = Store_{t+1}$$

$$Packaging_t = Packaging_{t-1} = Packaging_{t+1}$$

$$Brand_t = Brand_{t-1} = Brand_{t+1}$$

In some conditions, some of these conditions were relaxed to make them more suitable for the specific characteristics of data for some products. One thousand three hundred and twenty (1320) records were observed in the raw database for each country. The dataset comprises the

highly disaggregated micro-level retail price data underlying the computation of the National Index of Consumer Price (CPI) in statistical agencies in each of the three countries. These statistical agencies provide the data which was not published for the range of narrowly defined products. The dataset is made unique by the presence of all information to monitor products at the individual level, its coverage, cross-sectional as well as in the time dimension and the fact the dataset relates to West Africa.

The monthly disaggregated data cover a period of five years (sixty months) from January 2011 to December 2015. Month to month prices is used because it allows for the investigation of price-setting behaviour to be influenced by seasonal prices as these can cause price fluctuations in particular locations. It is important to capture such fluctuations across the countries for the study period because it allows the comparison of prices of individual products across the countries.

The dataset is only for product categories for which prices are recorded in a decentralized manner. The prices which are regulated and are principally determined by the government and are thus not included as these prices are not determined through the market system. Also excluded are products such as newspapers and magazines whose prices are set by the manufacturers, and not by market forces. Each product is comparable across locations since they share identical basic descriptions. Each store is visited once a month to gather the price reports. There may not, however, be perfect homogeneity across products and locations because the raw data are sometimes devoid of details in brand, units of measurement, colour, or other specific characteristics. As a result of this, there may exist product level differences between countries which may contribute to any observed frequency and size of price changes across countries.

The twenty-two products are banana, beans, rice, frozen chicken, okro, onion bulb, orange, pawpaw, plantain, potatoes, coca-cola, bath towel, blanket, brassiere, Girl dress, men shoe, women shoe, shirt boys, electric iron, refrigerator, university education and intercity bus transportation. These were further categorized by classification into analytical product types. The dataset by analytical product type consists of perishable food (30.36%), Non-perishable (13.64%), Non-food durable (9.09%), Non-food non-durable (31.82%) and Services (9.09%) in all countries. By COICOP classification, the shares of product categories are given as food and non-alcoholic beverages (50%), clothing and footwear (31.82%), household equipment (9.09%) and services (9.09%).

3.3. Theoretical Framework

The quantitative nature of the price-setting process can be investigated via the direct duration approach or the frequency approach. Calculating the duration directly from the raw data can be biased due to the presence of censored spells (Harchaoui, Michaud & Moreau, 2008) and thus restricted for use with uncensored spells only. But the exclusion of censored spells leads to downward bias and long-lasting spells are more likely to be discarded (Nchake, 2013). On the other hand, the frequency approach allows the use of the full data and avoids the potential bias from censored data. In this approach, the frequency of the price changes is computed as a proportion of the times a price for a product in a retail outlet is changed over T observation periods and then derives the measure of an implied duration of price spell. For large samples, the inverse of the frequency of price changes is a consistent estimator of the average duration of price spells.

Its drawback is that it calculates the inverse of the average frequency of price change instead of the average of the inverse of the frequency of price change (Gouvea, 2007). This causes the former measure to be smaller or equal to the latter due to Jensen's inequality (Nchake, 2013). However, studies that have computed both measures arrived at a similar order of magnitude for downward bias (Gouvea, 2007).

3.4 Model Specifications

The different dimensions of price-setting behaviour are addressed by the specifications below.

Frequency of price changes

An indicator variable is first created as

$$X_{ijt} = \begin{Bmatrix} 1\ if P_{ij} \neq P_{ijt-1} \\ 0\ if P_{ij} = P_{ijt-1} \end{Bmatrix} \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

$i =$ refers to product, $j =$ market, $t =$ time, $P_{ijt} =$ log price of product ***i*** *in market* ***j*** and month t.

This indicator is used to compute the average frequency of price changes for a product **i** in retail market j, over the period t as

$$Fr_{ij} = \left(\frac{1}{T_{ij}-1}\right)\sum_{t=2}^{T_{ij}} X_{ijt} \ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Fr_{jj} is the frequency of price changes of product **i** in market **j**,

T_{ij} is the number of observations of the price of product **i** sold by market **j**

p_{ijt} is the price of product i charged by market j in period **t**, x_{ijt} is as defined in equation (3.2).

Duration of price spells

The degree of price rigidity can also be based on the duration of a price spell. In principle, assuming that the price changes occur at discrete time intervals, the two concepts of measuring price rigidity are linked as

Duration of price spell $=\frac{1}{Fr_{ij}}$, for all I = 1....I, j = 1,……..J…….(3)

Direction of Price Changes

A two-step procedure is used to compute the number of price increases and decreases which are indicators that capture the direction of price changes. An indicator variable for price changes is defined as follows:

$$X_{ijt}^{+} = \begin{Bmatrix} 1\ if P_{ijt} > P_{ijt-1} \\ 0\ if otherwise \end{Bmatrix}$$

$$X_{ijt}^{-} = \begin{Bmatrix} 1\ if P_{ijt} < P_{ijt-1} \\ 0\ if otherwise \end{Bmatrix} \qquad \Delta$$

$P_{ijt} = P_{ijt-1}$ is not considered because there is no price change in the situation. The indicator variable in equation (3.5) captures the average frequency of price increase and decrease for a product i in market j over the period t as follows:

$Fr_{ij}^{+} = X_{ijt}^{+}$---------- (5)

$Fr_{ij}^{-} = X_{ijt}^{-}$---------- (6)

Where Fr_{ij}^{+}= the frequency of price increases in market *j* for a product *i*

Fr_{ij}^{-} =the frequency of price decreases for a product *i* in market *j*.

T_{ij}= Numbers of observation of the price product *i* sold in market *j*

P_{ijt}= price of product *i* charged by market *j* in period *t*.

Average Size of Price Changes

The mean absolute size of price change for a product *i* in market *j* over a defined period as:

$S_{ijt} = \frac{1}{N}\sum_{i}^{N} I_{ijt} \times \left|dp_{ijt}\right|$…….. (7)

Where:

S_{ijt}= mean absolute size of price change for a product i in market j

N = number of observations of non-zero price changes.

I= indicator variable which is equal to 1 if $dp \neq 0$ (0 otherwise).

dp_{ijt} = change in the log price of the product.

4. Results

4.1 Nigeria

The first set of results for each country relate to the frequency of price changes, the implied duration of price spells and the size of price changes. Table 1 reveals that the mean frequency of price change across products is 91percent per month. Furthermore, the distribution of the frequency of price change skewed toward 100 percent as only 5 percent is less than 50 percent per month while 91 percent of the frequency of price change of products lie above 80 percent. This indicates that the price in Nigeria is very flexible (almost perfect flexibility).

Table 1. Frequency of Price Change, Duration of Price Spell Size and Size of Price Change

Product	Frequency	Duration	Size
Banana	1	1	0.050816
Beans	1	1	0.045285
Rice	1	1	0.028114
Frozen chicken	0.915254	1.092593	0.010393
Okro	1	1	0.060066
Onion bulb	1	1	0.062495
Orange	1	1	0.070029
Pawpaw	1	1	0.064620
Plantain	1	1	0.004478
Potatoes	0.966102	1.035088	0.091368
soft drink	0.576271	1.735294	0.015790
Bath towel	0.966102	1.035088	0.045458
Blanket	0.932203	1.072727	0.059941
Brassiere	0.966102	1.035088	0.035925
Girl dress	0.932203	1.072727	0.046378
Men Shoe	0.864407	1.156863	0.018786
Women shoe	1	1	0.008544
Shirt boys	1	1	0.04036
Electric	0.79661	1.255319	0.036567
Refrigerator	0.79661	1.255319	0.022612
Education	0.338983	2.95	0.005705
Intercity Bus	0.898305	1.113208	0.04931
	0.90678	**1.17311**	**0.039684**

The implied duration of the price spell reveals that the price spells have a very short duration. Hence, the highest duration per product is education which has three months duration. For most of the products, the duration lies between one month and one and half months.

Table 2. Frequency of Price Changes Across Analytical Product Categories

Category	Mean Price Freq.	Median Price Freq.
AGGREGATE	0.906779661	0.966101695
GOODS	0.93559322	0.983050847
SERVICES	0.618644068	0.618644068
FOOD	0.950693374	1
Perishable	0.985169492	1
Non-perishable	0.858757062	1
NON-FOOD	0.917137476	0.93220339
Durable	0.796610169	0.796610169
Non- Durable	0.95157385	0.966101695

Table 2 reveals that food items (perishable) has the highest mean frequency of price change (98.5percent)` and are closely followed by non-perishable food items (85.9 percent) and non-durable products (95.2percent). Services have the lowest price flexibility (61.8percent).

Table 3. Frequency of Price Increases and Decreases Across

Analytical Product Categories

Product Category	Mean of Increase	Mean of Decrease
AGGREGATE	0.530816641	0.37596302
GOODS	0.551694915	0.383898305
SERVICES	0.322033898	0.296610169
FOOD	0.577812018	0.372881356
Perishable	0.612288136	0.372881356
Non-perishable	0.485875706	0.372881356
NON-FOOD	0.519774011	0.397363465
Durable	0.381355932	0.415254237
Non- Durable	0.559322034	0.392251816

Table 3 displays the frequency of price increases and decreases across analytical product groups which indicates the share of frequency of price increases and decreases in the total number of price changes per product group. This implies that price increases are generally more common than price decreases. It shows that foods have the greatest share of frequency of price increase. All categories have a greater share of frequency of price increase than decrease except durable goods which has 38 percent share of price increases as against the share of price decrease (41.5percent).

Table 4. Size of Price Changes across Product Categories

Category	Mean Price size.	Median Price Size.
AGGREGATE	**0.039684**	**0.021775818**
GOODS	0.040901	0.021775818
SERVICES	0.027508	0.015130443
FOOD	0.045768	0.021666508
Perishable	0.051783	0.038287288
Non-perishable	0.02973	0.015219928
NON-FOOD	0.034952	0.021885128
Durable	0.029589	0.016461814
Non- Durable	0.036485	0.021885128

Table 5. Size of Price Increases and Decreases across Analytical Groups.

Product Category	Price Decrease (Mean)	Price Increase Mean
AGGREGATE	0.043694717	0.040666
GOODS	0.045488489	0.041749
SERVICES	0.025757003	0.02984
FOOD	0.051329566	0.04515
Perishable	0.059544208	0.05079
Non-perishable	0.029423854	0.03011
NON-FOOD	0.038349394	0.037593
Durable	0.025382076	0.034327
Non- Durable	0.042054341	0.038526

Small sizes of price change are seen to be more common in Nigeria (Table 4). Table 5 reveals that the average size of price increases is smaller than the average size of price decreases except for services.

Figure 1: Seasonal Pattern of Frequency of Price change and price increases decreases.

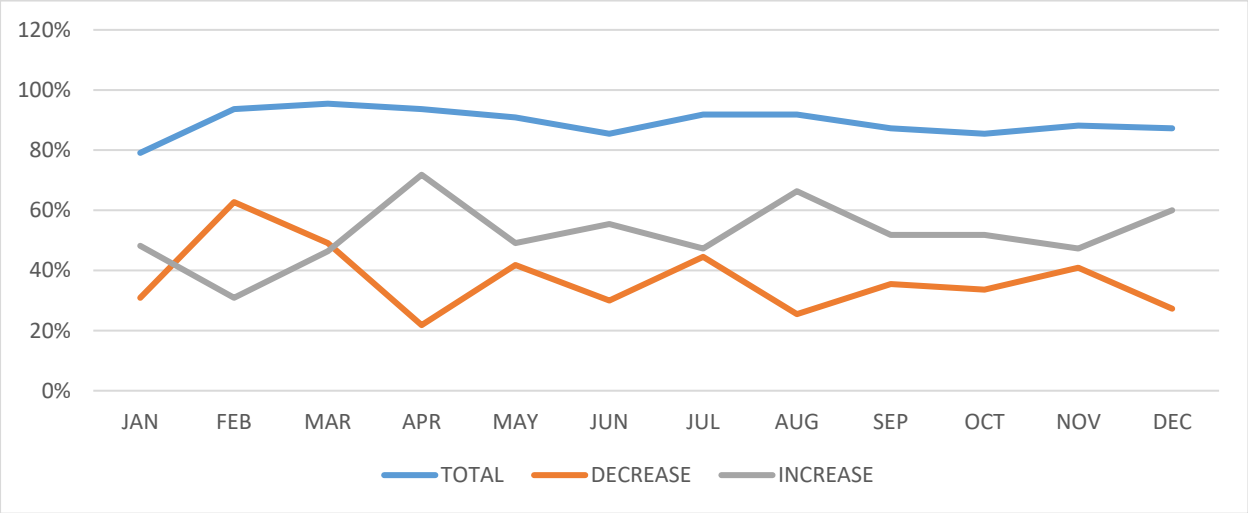


Figure 1 shows the seasonal pattern of the frequency of price changes across products distinguishing between price increase and decreases. An examination of the graph shows that price changes are most frequent between February and April and least frequent in January (79percent) and June (85percent). It is seen that price change are very frequent throughout the year.

Figure 2: Inflation and Frequency of Price Change

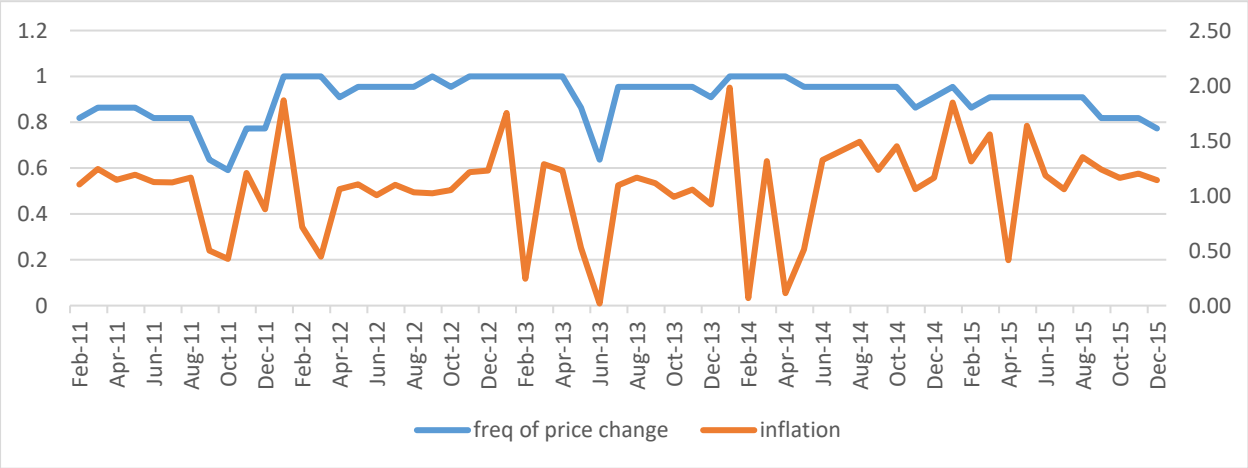
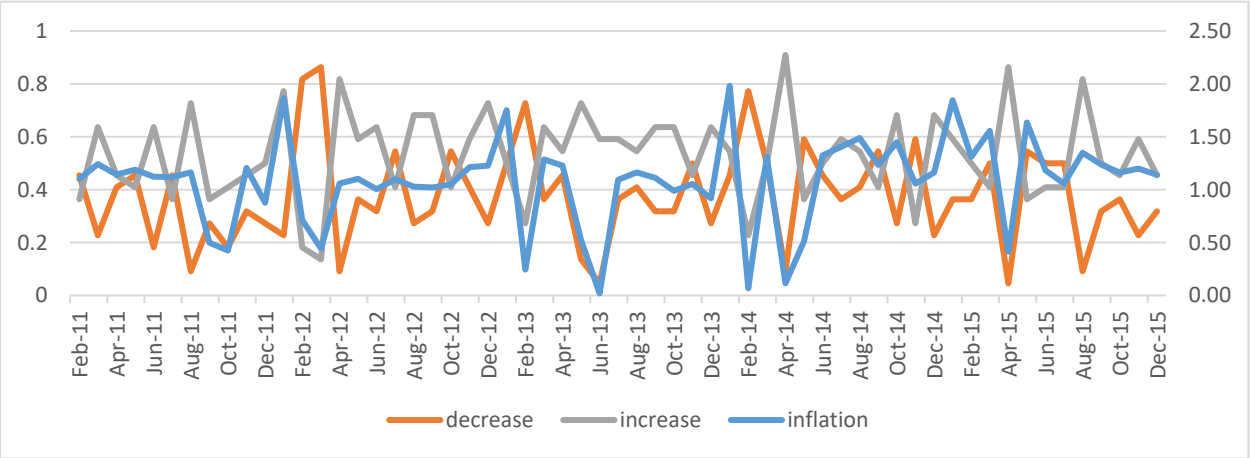
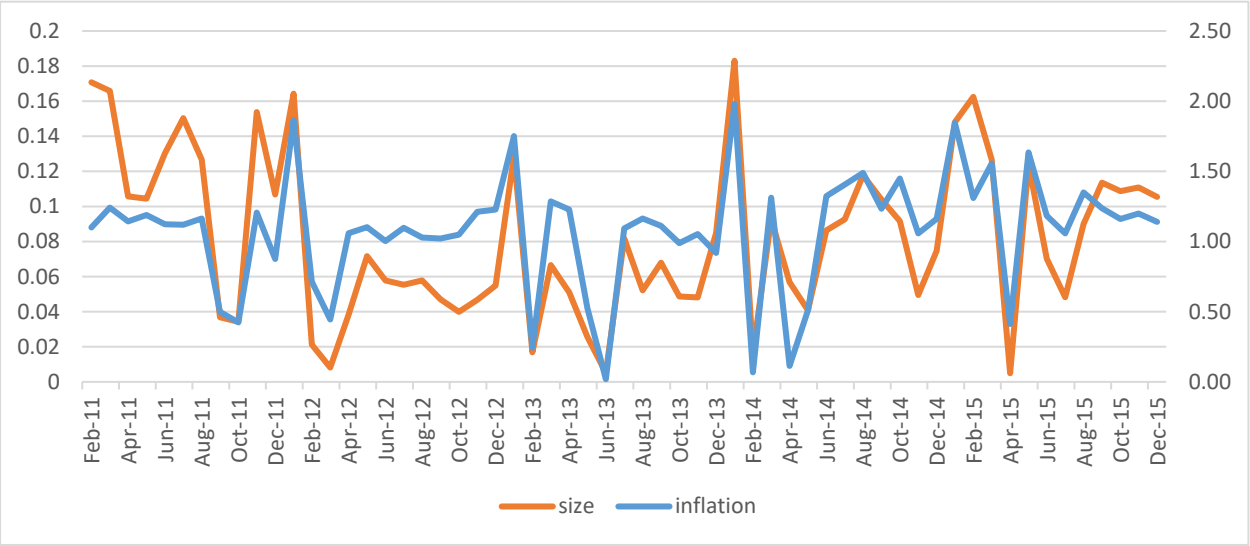


Figure 3: Inflation and Frequency of Price Increases and Decreases



An examination of Figure 2 reveals that for a majority of the months the frequency of price change co-varies with inflation. However, Figure 3 of frequency of price increase and price decreases show that do not co-move with inflation even though inflation seems to have a more pronounced effect on the frequency of price increases than on price decreases, evidence prices being rigid downward. The figures also show that the frequency of price increase tends to increase in about April yearly whereas price decreases tend to move more in June every year. Figure 3 also shows that the period of high inflation coincides with the period of more frequency of price increases. Retail prices, therefore, appears to be responsive to economic events (inflation in this case), reflecting in the part of the economic uncertainties in the economy. Figures 4 and 5 are computed using all the products for price increases and price decreases respectively for the entire observation period.

Figure 4: Inflation and Size of Price Change



In Figure 4 inflation moves with size of price of changes. It can be concluded that this is an evidence of state dependent pricing rule.

4.2 Republic of Benin

Table 6 presents the frequency and size of price changes as well as duration of price spells in the Republic of Benin. Estimated monthly frequency range from 6 percent (electric iron and refrigerator, i.e. household equipment) to 96.6 percent for rice (food item). All the high frequency item are food item.

Table 6. Frequency of Price change, Duration of price spell and Size of Price Change

Products	FREQ OF PRICE CHANGE	DURATION OF PRICE SPELL	SIZE
Banana	0.932203	1.072727	0.019888
Beans	0.694915	1.439024	0.03007
Rice	0.966102	1.035088	0.010185
Frozen chicken	0.440678	2.269231	0.00801
Okro	0.932203	1.072727	0.058567
Onion bulb	0.932203	1.072727	0.081827
Orange	0.847458	1.18	0.081088
Pawpaw	0.847458	1.18	0.033481
Plantain	0.949153	1.053571	0.03248
Potatoes	0.813559	1.229167	0.013838
soft drink	0.118644	8.428571	0.157809
Bath towel; medium size	0.101695	9.833333	0.166568
Blanket	0.118644	8.428571	0.165104
Brassiere	0.135593	7.375	0.167401
Girl dress (little)	0.101695	9.833333	0.206021
Men Shoe (leather)	0.101695	9.833333	0.264941
Women's shoe	0.118644	8.428571	0.168565
Shirt boys	0.135593	7.375	0.145606
Electric iron	0.067797	14.75	0.350488
Refrigerator	0.067797	14.75	0.351499
Education	0.118644	8.428571	0.232568
Intercity Bus	0.118644	8.428571	0.084538
	0.439137	5.840778	0.128054

Table 6 also presents the duration of price spell for a product which varies substantially across from about one month for rice to about 15 months for electric iron and refrigerator, household equipment. This shows that the price-setting behaviour is very heterogeneous across products.

Viewing the average size of price changes across products (Table 6) also reveals that refrigerator and electric iron have the highest size of price changes with 0.351 and 0.350 respectively. The smallest size is found in frozen chicken (0.008) and rice (0.010).

Table 7. Frequency of price changes across product categories

Category	Mean Price Frequency.	Median Price Frequency.
AGGREGATE	0.439137	0.135593
GOODS	0.471186	0.288136
SERVICES	0.118644	0.118644
FOOD	0.770416	0.847458
Perishable	0.836864	0.889831
Non-perishable	0.59322	0.694915
NON-FOOD	0.105461	0.101695
Durable	0.067797	0.067797
Non- Durable	0.116223	0.118644

Table 7 shows that food has the highest perishable frequency of price change while services and non-food items have the lowest following the literature and theory (see, For instance, Kovanem, 2006: Nchake, 2013).

Table 8: Frequency of Price Increase and Price Decreases by Analytical Product Groups

Product Category	Mean of increase	Mean of Decrease
AGGREGATE	0.228043	0.210324
GOODS	0.245763	0.225424
SERVICES	0.067797	0.050847
FOOD	0.399076	0.371341
Perishable	0.442797	0.394068
Non-perishable	0.282486	0.310734
NON-FOOD	0.05838	0.047081
Durable	0.042373	0.025424
Non- Durable	0.062954	0.053269

Table 8 depicts the frequency of price increases and decreases by analytical product group. Price increases occur slightly (22.8 percent) more frequently than price decrease (21 percent). Food items have the highest frequency of price increases and frequency of price decreases as well.

Table 9: Size of Price change by Analytical Grouping

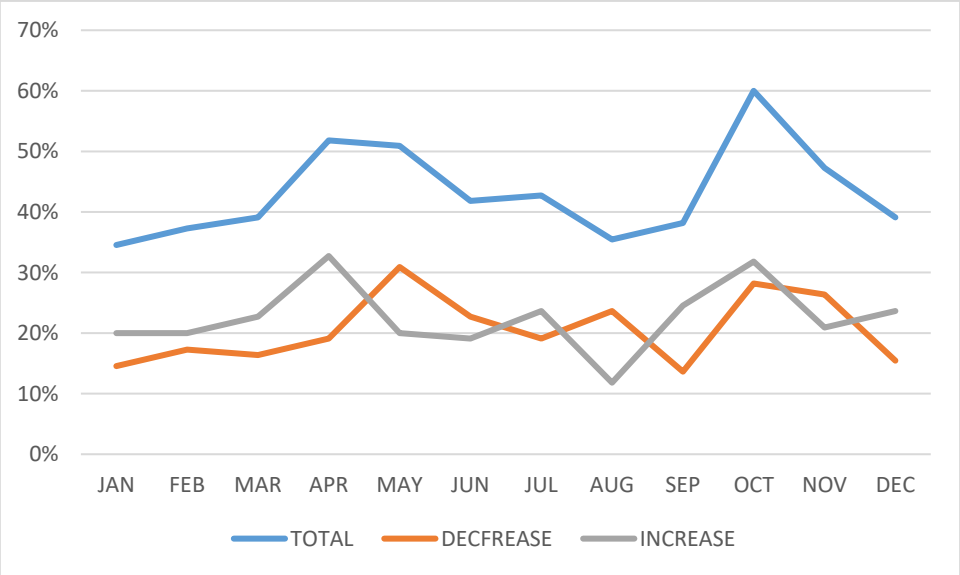
Category	Mean Size	Median size
AGGREGATE	0.128661	0.056671
GOODS	0.125672	0.048285
SERVICES	0.158553	0.169974
FOOD	0.047931	0.025163
Perishable	0.041147	0.026617
Non-perishable	0.066021	0.023044
NON-FOOD	0.220688	0.179374
Durable	0.350993	0.351648
Non- Durable	0.183458	0.075719

Table 10. Size of Price Increases and Decreases across product categories

Product Category	Mean Price Increase	Mean Price decrease
AGGREGATE	0.121066	0.149578
GOODS	0.117891	0.147916
SERVICES	0.152816	0.166202
FOOD	0.050581	0.046082
Perishable	0.04069	0.041741
Non-perishable	0.076956	0.057658
NON-FOOD	0.200159	0.272379
Durable	0.293081	0.524729
Non- Durable	0.173609	0.200279

When viewed across the analytical groups (Table 8) perishable foods have the smallest mean size (0.041) while durable goods have the biggest mean size of price change. This implies that primary products with a high frequency of price change (shortest duration of price spells) have the smallest sizes. These products change their prices more rapidly.

Figure 5: Seasonal Pattern of Price Changes and price increases and decreases.



The frequency of price change is highest in October and lowest in January and August (Fig.5). Price decreases are most frequent in May and most prices increases are in April May respectively. The spectrum of the frequency of price decrease is between 14 percent and 31 percent and of price increases is between 12 percent and 33 percent.

Figure 6: Inflation and the Frequency of Price Changes

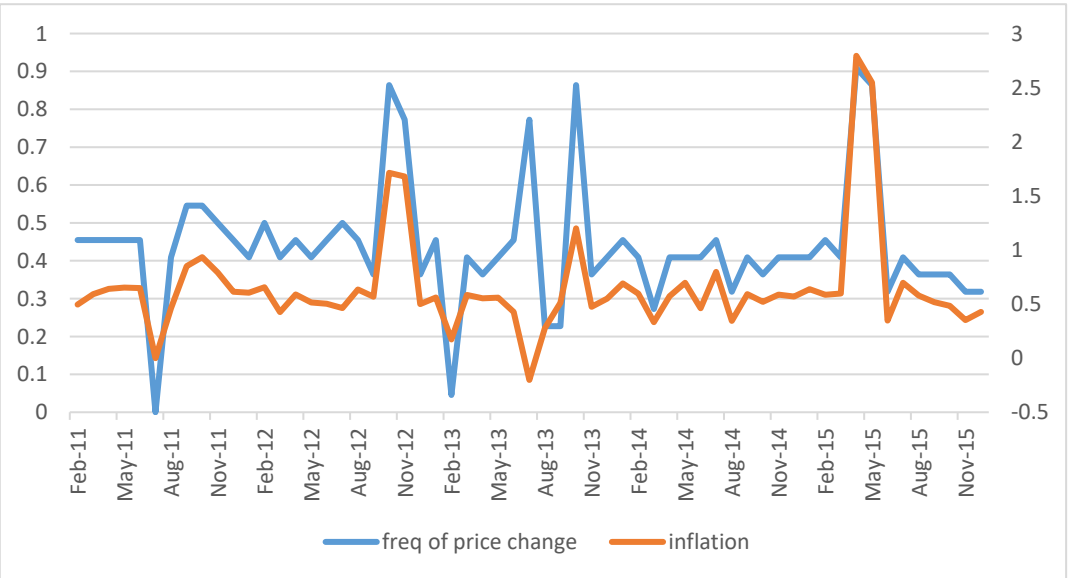


Figure 6 allows the comparison of the time series of the frequencies of price changes showing the monthly frequencies of price changes and aggregate inflation for our observational period. It is concluded that generally, inflation co-moves with the frequency of price change. The phenomenon is symptomatic of state-dependent characteristics in price-setting behaviour.

Figure 7 Inflation and frequency of Price Increases & Decreases

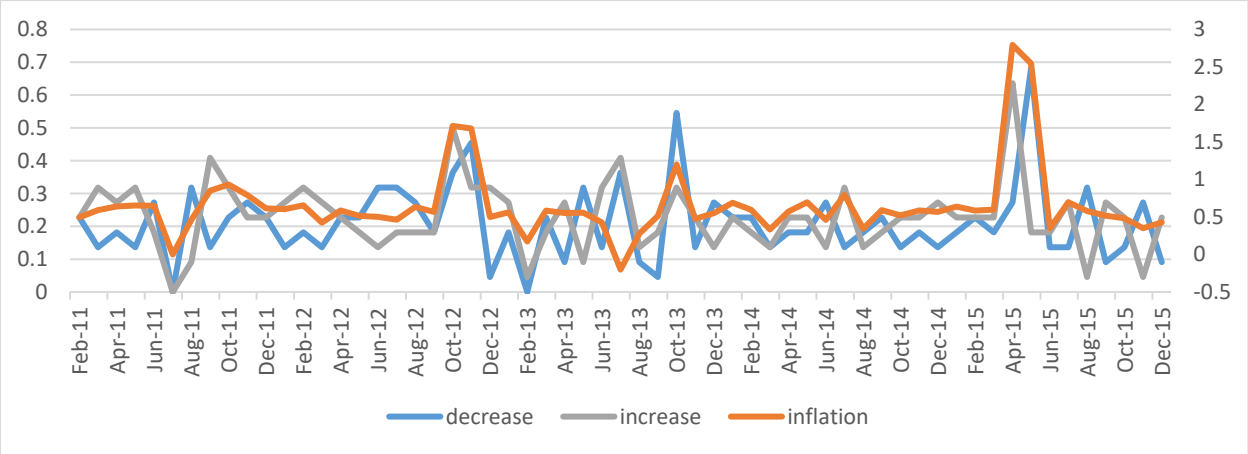
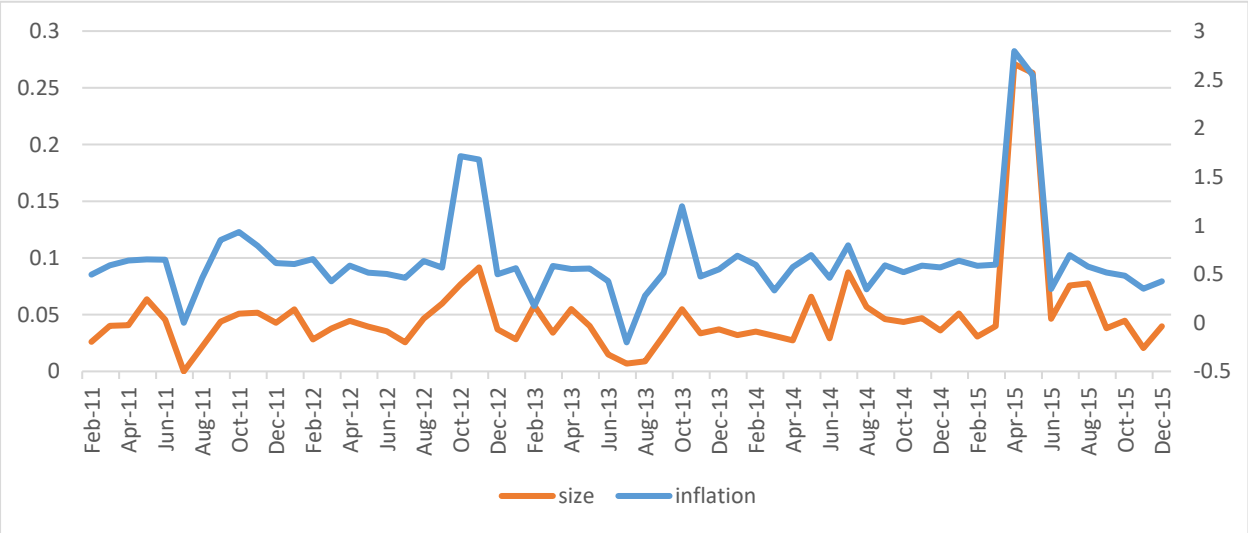


Figure 7 shows that the frequency of price increases seem to dominate the trend of inflation.

Figure 8: Inflation and Size of Price change



Inflation co-varies with a size of price change.

4.3 Togo

Table 11: Frequency of Price change and Duration of Price Spell

PRODUCT	FREQ. OF PRICE CHANGE	DURATION OF PRICE SPELL	SIZE OF PRICE CHANGE
Banana	0.983051	1.01724	0.038203
Beans	0.983051	1.01724	0.038055
Rice	0.79661	1.25532	0.024226
Frozen chicken	0.677966	1.475	0.017235
Okro	0.983051	1.01724	0.074175
Onion bulb	0.389831	2.56522	0.081691
Orange	0.881356	1.13462	0.107061
Pawpaw	0.59322	1.68571	0.080222
Plantain	0.983051	1.01724	0.048083
Potatoes	0.966102	1.03509	0.032247
soft drink (coca-cola)	0.152542	6.55556	0.008971
Bath towel	0.033898	29.5	0.016152
Blanket	0.050847	19.6667	0.020055
Brassiere	0.084746	11.8	0.030103
Girl dress (little)	0.322034	3.10526	0.009157
Men Shoe (leather)	0.135593	7.375	0.004466
Women's shoe	0.101695	9.83333	0.006909
Shirt boys	0.169492	5.9	0.016601
Electric iron	0.254237	3.93333	0.062471
Refrigerator	0.152542	6.55556	0.095349
Education	0.101695	9.83333	0.011087
Intercity Bus (taxi)	0.016949	59	0.063669
	0.446071	**8.46718**	**0.040281**

The frequency of price change across products is shown in Togo in Table 11. The price-setting behavior covers a broad spectrum ranging from almost perfect flexibility for banana, beans and

okro to a high degree of price rigidity for education and intercity transportation (service sector). The average frequency is 44.6 percent as seen in Table 11.

Table 12 reveals that food has the highest frequency of price change among analytical categories, that is, most flexible (76.3 percent). The table also shows that services have the lowest frequency of price change (5.9 percent), that is, the price of services is the most rigid.

Table 12: Frequency of Price Change by Analytical Group

Category	Mean Price Freq.	Median Price Freq.
AGGREGATE	0.446070878	0.288135593
GOODS	0.484745763	0.355932203
SERVICES	0.059322034	0.059322034
FOOD	0.762711864	0.881355932
Perishable	0.80720339	0.923728814
Non-perishable	0.644067797	0.796610169
NON-FOOD	0.145009416	0.13559322
Durable	0.203389831	0.203389831
Non- Durable	0.150847458	0.144067797

Table 13: Frequency of Price Increase & Decreases by Analytical Type

Product Category	Mean of increase	Mean of Decrease	Median of Increase	Median of Decrease
AGGREGATE	0.239599	0.206471	0.144068	0.144068
GOODS	0.258475	0.226271	0.177966	0.177966
SERVICES	0.050847	0.008475	0.050847	0.008475
FOOD	0.403698	0.359014	0.440678	0.355932
Perishable	0.419492	0.387712	0.440678	0.415254
Non-perishable	0.361582	0.282486	0.440678	0.355932
NON-FOOD	0.080979	0.06403	0.067797	0.050847
Durable	0.101695	0.101695	0.101695	0.101695
Non- Durable	0.075061	0.053269	0.067797	0.033898

The frequency of price increase and decrease are shown across analytical product groups in Table 13. Aggregate frequency of price increase (24percent) is slightly more than the aggregate frequency of price decrease (20.6percent).

Table 14: Size of Price Change by Analytical Product Type

Category	Mean	Median
AGGREGATE	0.040281	0.016081
GOODS	0.040572	0.016081
SERVICES	0.037378	0.037281
FOOD	0.050015	0.026871
Perishable	0.059865	0.044212
Non-perishable	0.023751	0.011746
NON-FOOD	0.029029	0.013197
Durable	0.07891	0.016866
Non- Durable	0.014777	0.008525

Table 18 also show the report of the size of price change by major groups. Price adjustment is lumpy being average of 4.03 percent. It is 5 percent for food, 4 percent for services and 3 percent for non-food. Prices change by large amounts when they do change.

Table 15 Frequency of Price Increases and Decreases Across Product Categories

Product Category	Mean price increase	Mean price decrease
AGGREGATE	0.037119	0.050117
GOODS	0.037122	0.049742
SERVICES	0.037096	0.006954
FOOD	0.046772	0.056529
Perishable	0.055555	0.06857
Non-perishable	0.023352	0.024421
NON-FOOD	0.025326	0.041446
Durable	0.06209	0.045257
Non- Durable	0.014823	0.040358

Figure 9. Seasonal pattern of price changes increases and decreases.

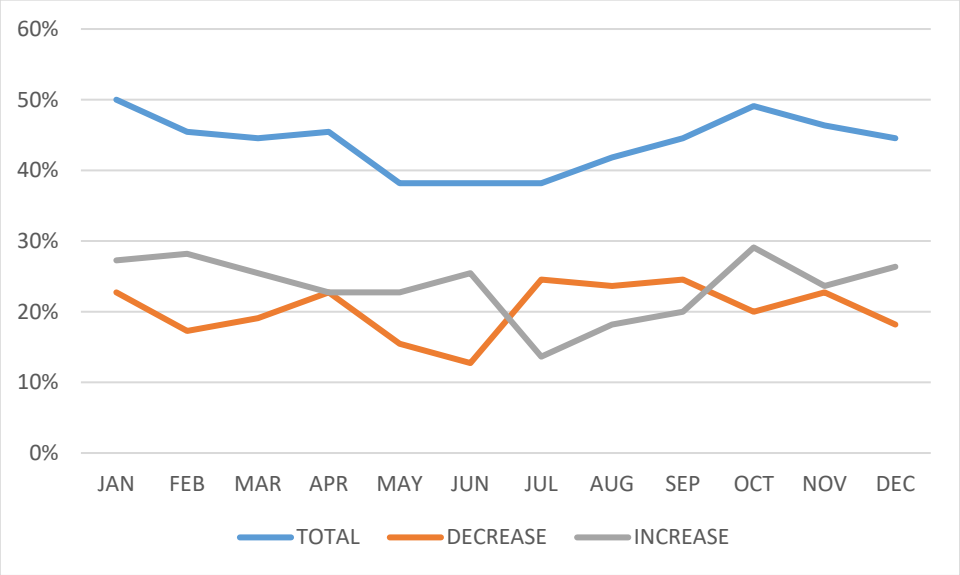
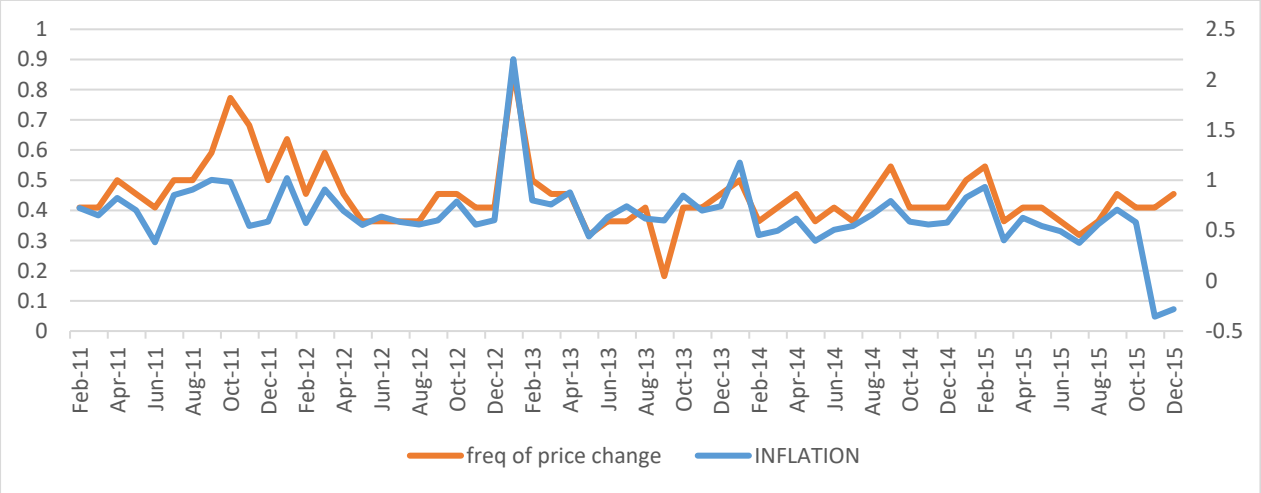


Figure 9 presents the seasonal pattern of overall price changes, increases and decreases. The frequency of product prices is highest at 50 percent in January and October.

Figure 10: Inflation and Frequency of price change



It is observed in Figure 10 that the frequency of price changes co-varies with inflation during the period 2011 to 2015 except in November 2011.

Figure 11: Inflation and Frequency of Price Increase & Decrease

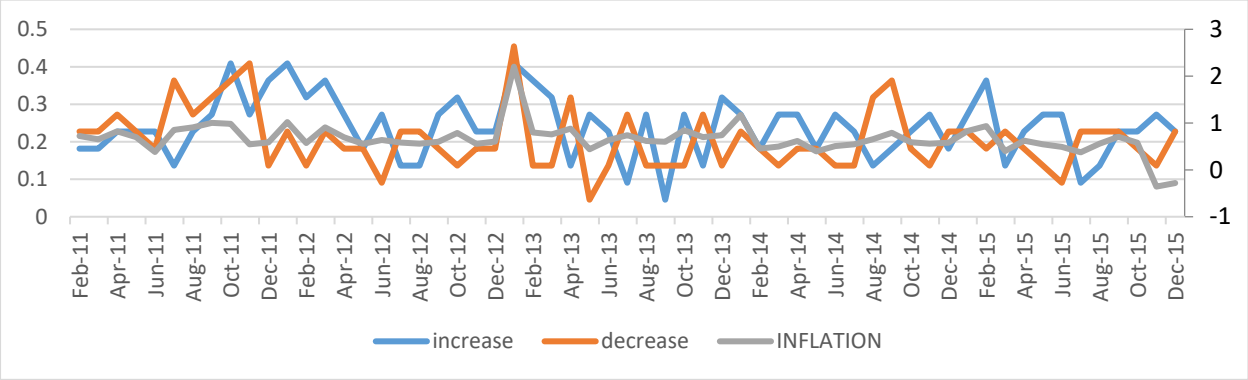
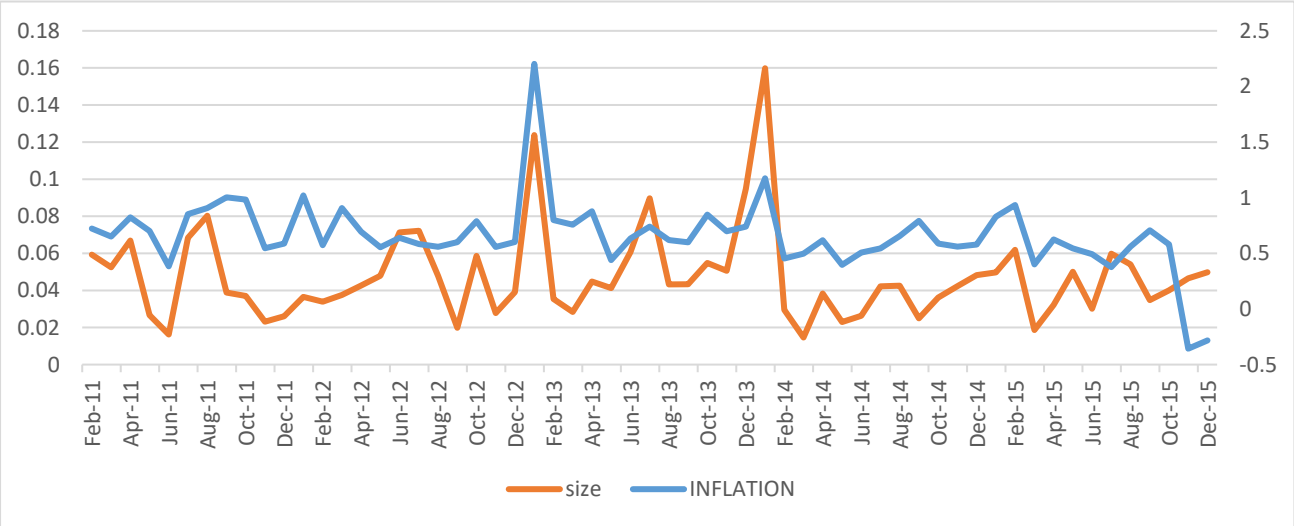


Figure 11 presents the graph of the trend of the frequency of price increases and the frequency of price decreases along with the trend in inflation during the 2011 to 2015 period. There seems to be no relationship among any of them.

Figure 12: Inflation and Size of Price Change



The graph (Figure 12) indicates that inflation co-varies with the size of price changes.

4.4 Discussion of Results

This section discusses the principal findings of this study to analyze the characteristics of price-setting behaviour in ECOWAS and thereby identify the main price-setting model applicable in the region. Table 1, Table 6 and Table 11 present the frequency of price change in the three ECOWAS countries. There are two important deductions from these results. First, the frequency of price change is higher for Nigeria (91 percent) than both Benin (44.6 percent) and Togo (43.9 percent), suggesting that prices are more volatile in Nigeria than in the other two countries suggesting an adverse effect of different monetary regimes on price stability. Second, the frequencies of price

change for the three countries are relatively high compared to those of developed countries where a low frequency of price change is common. For example, the frequency of price change in the Euro Area is 15 percent while that of Southern Africa Development Commission is 36 percent and it is 51 percent for Sierra Leone (Dhyne et al., 2006; Nchake, 2013; Kovanen, 2006). According to Kovamen (2006), a principal reason for the high frequency of price change in developing countries is because their economies are basic, producing mainly primary and unprocessed items whose prices are volatile making the retailer dispose of the products much more quickly to avoid selling below the marginal costs. Food items that have the highest frequency of price change in ECOWAS countries (Tables 2, 7 and 12) have a very significant on consumer price index are primary products that by nature have little value added beyond their primary input costs to absorb other costs (mainly distribution and storage costs). Since primary inputs are not diversified, the prices of primary products are likely to change more frequently in response to cost change.

Price-setting behaviour being very flexible implies that macroeconomic modelling should preferably incorporate a flexible sector. This will have an impact on inflationary dynamics and imply the conduct of monetary policy, particularly for the type of inflation stabilization which is an optimal and optimal reaction to relative price changes.

The rigidity in the service sector (Table 2, Table 7, Table 12) could be because services are mostly non-tradable and are not subject to distribution and transport costs. It also has a high proportion of value-added thus making it easier for retailers to absorb an increase in production cost of services (at least in the short run) to contain frequent price changes. The lower frequency of price change could also reflect the lower volatility of consumer demand for them and thus also making it easier for the retailers to absorb an increase in production costs at least in the short run.

Tables 3, 8 and 13 reveals that there are more price increases than price decreases because prices are rigid downward. These results are in line with Baudry et al, (2004) for France with a price increase of around 60percent, and Dias & Neves (2004) for Portugal with a share of price increases around 62 percent. The lowest share of frequency of price decrease is found in Services. Services are most rigid upward and downward because of their potential to absorb input costs. The result that the average frequency of price increases dominates the frequency of price decreases is consistent with findings that in an environment of positive inflation where the frequency of price increases exceeds the frequency of price decreases.

The sizes of price change for Nigeria, the Republic of Benin and Togo are as shown in Tables 4, 9 and 13. The sizes of price change are higher in the Republic of Benin than in other places. It is also

observed that while the size of price change for food is highest in Togo and Nigeria, the size of price change for services is the largest in Benin. The sizes of increases are smaller than the sizes of decreases in all the countries. This could be a result of the downward rigidity of prices.

Price changes in Nigeria are very frequent throughout the year (Figure 1). The spectrum of price change is lower and wider in Benin and Togo being between 35 percent and 60 percent in Benin (Figure 5) and between 38 percent and 50 percent in Togo (Figure 9). The period high frequency of price change in Nigeria appears to correspond to periods of economic activities, which is depending on the economic environment which is being interpreted as a state-dependent pricing process. The seasonal pattern of frequency of price change seems to be symptomatic for the existence of a few time-dependent characteristics in Benin and Togo. However, we cannot exclude unambiguously the possibility of the fact that this seasonality is compatible with state-dependent pricing as it may result from a seasonal profile in the cost components, menu costs.

Inflation is consistently high in Nigeria (Figure 2). However, it tends to co-vary with the frequency of price change. The characteristics of frequency of price change co-moving with inflation depicts evidence of state dependence pricing rule. Figure 3 of frequency of price increase and price decreases show that they do not co-move with inflation even though inflation seems to have a more pronounced effect on the frequency of price increases than on price decreases, evidence of prices being rigid downward. Also, figure 3 shows that the period of high inflation coincides with a period of more frequency of price increases. Retail prices, therefore, appears to be responsive to economic events (inflation in this case), reflecting in the part of the economic uncertainties in the economy. For Benin (Figures 2 and 3) and Togo (Figures 10 and 11), evidence of state dependence pricing is exhibited in both countries as inflation co-moves with the frequency of price changes.

In all the countries examined, inflation co-moves with the size of price change. This is quite different in industrial countries, where the volatility of inflation is typically associated with the volatility of the average size of monthly price changes whereas the frequency of monthly price changes remains relatively stable. This implies that firm in industrial countries follows mostly time-dependent pricing model when adjusting their output (Kovanen, 2006).

5. Conclusions and Policy Implications

A better way to gain more insight into the dynamics of macroeconomic variables is to understand their macroeconomic foundations. This paper uses highly disaggregated micro-level retail price data underlying the computation of the National Consumer Price Index (CPI) in ECOWAS, using Nigeria, Benin, and Togo as samples, to analyse price-setting behaviour in the region and through

this gain more insights into price rigidities and inflation dynamics in the region. The choice of ECOWAS is important for two reasons. Firstly, there is a scarcity of studies on price-setting behaviour in the region and given how important trade relations among member states have evolved since ECOWAS was established in 1975, it is important to conduct a study of this nature. Secondly, countries within ECOWAS operate two different monetary regimes and there is the possibility that this might imply price-setting behaviour among member nations.

Findings from this project showed that price-setting behaviour differs across the three countries- Nigeria, Togo, and Benin- used as samples for the sub-region. Specifically, the frequency of price changes is not the same across the three countries and there are more price increases than price decreases and the average price spell varies across the three countries differs. Finally, inflation co-varies with size of price changes for the three countries indicating that state dependent pricing model fits the data for the region than time dependent pricing model. These results have two policy implications. Firstly, policymakers in the region should pursue a stable macroeconomic environment to reduce the consequences of state-dependent price setting in a region where the economy is prone to exogenous macroeconomic shocks. Secondly, there is evidence of less price volatility in Togo and Benin than in Nigeria and this may be because they belong to different monetary unions. There is the need, therefore, to reduce the negative effect of different monetary unions on price adjustments in ECOWAS.

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